POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day	Observatory
1937	h m	°	°	°				
May 18	11 4	−37.0	179.9	+19.0	145			U. S. Naval.
		−28.0	188.9	−15.0		1,164		
		−20.0	196.9	+23.0	12			
		−11.0	205.9	−19.0		97		
		+30.5	247.4	−30.5	24			
		+41.0	257.9	+20.0		436		
		+54.0	270.9	−17.0		291	3,138	
May 19	10 39	−87.0	116.9	−19.5	242			Do.
		−65.0	138.9	+10.5		242		
		−35.0	168.9	+18.5		388		
		−25.0	178.9	+28.5	194			
		−24.0	179.9	+19.0	145			
		−14.0	189.9	−16.0		1,164		
		−7.0	196.9	+23.0	24			
		+2.5	206.4	−19.0		97		
		+43.0	246.9	−30.5	24			
		+53.0	256.9	+20.0		339		
		+65.0	268.9	−17.0		388	3,247	
May 20	11 10	−73.0	117.3	−19.5	291			Do.
		−51.0	139.3	+11.0		242		
		−21.0	169.3	+19.5		388		
		−11.0	179.3	+28.5	194			
		−10.0	180.3	+19.0	145			
		−1.0	189.3	−16.0		1,406		
		+7.0	197.3	+23.0	24			
		+13.0	203.3	−19.0		97		
		+67.0	257.3	+20.0		339		
		+80.0	270.3	−17.0		388	3,514	
May 21	11 7	−76.0	101.1	+12.0		970		Do.
		−60.0	117.1	−20.0	436			
		−38.0	139.1	+11.0		242		
		−10.0	167.1	+19.5		242		
		+0.5	177.6	+28.5		194		
		+1.0	178.1	+19.0	145			
		+12.0	189.1	−16.5		1,745		
		+19.0	196.1	+21.0		97		
		+28.0	205.1	−19.0		48		
		+81.0	258.1	+20.0		291	4,410	
May 22	11 42	−64.0	99.6	+12.0		873		Do.
		−46.0	117.6	−20.0	533			
		−39.0	124.6	+10.5		97		
		−27.0	136.6	+10.5		73		
		−21.0	142.6	+10.0	194			
		+6.0	169.6	+19.5		218		
		+14.0	177.6	+27.0		242		
		+16.5	180.1	+19.0	145			
		+25.0	188.6	−16.0		1,309		
		+32.0	195.6	+21.0		339		
		+41.0	204.6	−18.0		48	4,071	
May 23	9 59	−53.0	98.3	+13.0		921		Mt. Wilson.
		−35.0	116.3	−20.0	582			
		−27.0	124.3	+12.0		194		
		−14.0	137.3	+12.0		48		
		−10.0	141.3	+10.0		145		
		+19.5	170.8	+20.0		145		
		+27.0	178.3	+28.0		194		
		+29.5	180.8	+19.5	121			
		+40.0	191.3	−17.0		1,212		
		+48.0	199.3	+23.0		970		
		+57.0	208.3	−19.0		97	4,629	
May 24	11 9	−62.0	75.4	+6.0	12			U. S. Naval.
		−35.0	102.4	+12.0		776		
		−20.0	117.4	−20.0	485			
		−10.0	127.4	+12.0		48		
		+5.5	142.9	+9.5	121			
		+30.0	167.4	+19.5		73		
		+40.0	177.4	+27.0		97		
		+41.5	178.9	+19.0	73			
		+51.0	188.4	−16.0		1,115		
		+59.5	196.9	+21.5		1,018	3,818	
May 25	11 9	−50.0	74.2	+6.0		48		Do.
		−21.5	102.7	+12.5		776		
		−7.5	116.7	−20.0	485			
		+19.0	143.2	+10.0	97			
		+45.0	169.2	+19.0		48		
		+51.0	175.2	+27.0		97		
		+56.0	180.2	+18.5	97			
		+59.0	183.2	+29.0	24			

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Heliographic: Diff. in longitude	Heliographic: Longitude	Heliographic: Latitude	Area: Spot	Area: Group	Total area for each day	Observatory
1937	h m	°	°	°				
May 25	11 9	+65.0	189.2	−17.0		1,115		U. S. Naval.
		+73.0	197.2	+21.0		970	3,757	
May 26	12 0	−37.0	73.5	+5.0		48		Do.
		−8.0	102.5	+12.0		679		
		+8.0	118.5	−20.0	485			
		+32.0	142.5	+9.5	73			
		+66.0	176.5	+27.0		97		
		+69.0	179.5	+18.5	73			
		+70.0	180.5	−16.0	97			
		+83.0	193.5	−14.0		194	1,746	
May 27	10 53	−25.0	72.9	+5.0		97		Do.
		+6.0	103.9	+12.0		679		
		+15.5	113.4	−16.0		24		
		+20.0	117.9	−20.0	485			
		+45.0	142.9	+9.5	48		1333	
May 28	11 0	−11.0	73.6	+5.0		73		Do.
		+19.0	103.6	+12.0		679		
		+33.0	117.6	−20.0	436			
		+37.0	121.6	+13.0		48		
		+59.0	143.6	+9.0	48		1284	
May 29	11 1	−85.0	346.3	+11.0		388		Do.
		+3.0	74.3	+5.0		73		
		+32.0	103.3	+12.0		679		
		+47.0	118.3	−20.0	436			
		+51.0	122.3	+12.5		97		
		+70.0	141.3	+9.0	24		1697	
May 30	8 41	−73.0	346.4	+12.0		679		Mt. Wilson.
		−4.0	55.4	+16.0		145		
		+13.0	72.4	+5.0	48			
		+44.0	103.4	+11.0		727		
		+61.0	120.4	−21.0	436			
		+65.0	124.4	+11.5		194	2229	
May 31	8 42	−57.0	349.1	+12.0		582		Do.
		+11.0	57.1	+16.0		242		
		+60.0	106.1	+10.5		824		
		+71.0	117.1	+11.0	97			
		+71.0	117.1	−22.0	436		2181	

Mean daily area for 31 days, May, 2089.

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR MAY 1937

[Dependent alone on observations at Zurich and its station at Arosa]

[Furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

May 1937	Relative numbers	May 1937	Relative numbers	May 1937	Relative numbers
1	89	11	*a* 99	21	*aad* 154
2	91	12	91	22	*Eac* 194
3	77	13	—	23	202
4	*ad* 56	14	*Ecd* 111	24	*a* 213
5	59	15	*ad* 140	25	171
6	46	16	*Wc* 183	26	*a* 130
7	47	17	184	27	*b* 93
8	*Ec* 50	18	*d* 158	28	71
9	*d* 68	19	158	29	*Ecd* 83
10	*Mac* 103	20	*bd* 177	30	103
				31	98

Mean, 30 days=116.9.

a=Passage of an average sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a group developing into a middle sized or large center of activity; *E*, on the eastern part of the sun's disc; *W*, on the western part; *M*, in the central circle zone.
d=Entrance of a large or average sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. Little, in charge]

By LOYD A. STEVENS

Mean free-air data, based on airplane weather observations during the month of May 1937, are given in tables 1 to 3.

The mean surface temperatures for May (see ch. I) were, in general, above normal over the entire country; the departures from normal being small except over the central and northern portions of the Rocky Mountain and Western Plateau regions and along the New England coast, where, for individual stations, they amounted to between 2° and 3° C.

The mean free-air temperatures for the month up to 5 km above sea level (table 1) were slightly above normal over the greater portion of the country; negative departures being confined, for the most part, to the extreme northwest and the southeast portions of the country. The eastern area of negative departures was small at

0.5 km, being evident in the records of only Norfolk and Murfreesboro, but increased with height until at 4 km it covered approximately the entire region east of a line between Lakehurst, N. J., and San Antonio, Tex. The greatest negative departure (−2.4° C.) occurred at Norfolk, Va. at 2 km and the greatest positive departure (+2.3° C.) occurred at Billings, Mont. at 5 km.

The mean free-air relative humidities, as shown in table 2, were in general near normal. The greatest negative departure (−8 percent) occurred at Pensacola, Fla. at 0.5 km and the greatest positive departure (+8 percent) occurred at Oklahoma City, Okla. at 5 km. At San Antonio, Tex. the relative humidity was generally below normal at all upper levels. At Fargo, N. Dak., Scott Field, Ill., and Mitchell Field, N. Y., on the other hand, it was above normal at all levels. Over the southeast portion of the country it was below normal up to 1.5 km, above normal at intermediate levels and below normal again at 5 km. At Omaha and Oklahoma City the trend was similar to that over the southeast portion of the country except that positive departures persisted up to the 5 km level.

Monthly mean free-air barometric pressures and equivalent potential temperatures are shown in table 3. The mean isobaric charts for 0.5 and 1 km, as drawn from these values, were characterized by high pressure over the southeast and northwest sections of the country (the higher pressure prevailing over the former region) and by a trough of low pressure extending in a NE.–SW. direction from the northern plains States to the southern California coast. In the higher levels, one statistical center of low pressure was located over Fargo and Sault Ste. Marie and another over Seattle, Wash., while the highest mean pressure prevailed over the west Gulf coast. An examination of the mean pressure gradients between selected pairs of stations indicated that, in general, there was a decrease in pressure gradient varying from 20 to 50 percent over most of the country from April to May. From San Antonio to Oakland, on the other hand, the mean pressure gradient was reversed at 0.5 km and showed a marked increase over April up to 2.5 km. It agreed closely, however, with the gradient for the month of March.

Free-air resultant winds based on pilot balloon observations made near 5 a. m. (75th meridian time), are shown in table 4. The resultant winds, with a few exceptions were close to the normal in both direction and velocity at most stations at all levels. The most notable exceptions follow: At San Diego the resultant directions varied from the normal in a clockwise direction by amounts of from 35° to 80° between 0.5 km and 2 km. At Pensacola at 0.5 km the current months' resultant was 300° (WNW.) and 2.0 m. p. s. while the normal was 117° (ESE.) and 0.8 m. p. s., also at 4 km the current resultant direction varied from the normal in a clockwise direction by approximately 80° and the velocity was less than 50 percent of the normal. At Seattle the current month's resultant directions varied from the normal in a counterclockwise direction and the velocities were above normal at all levels up to 3 km; the greatest variation occurring at 2 km where the current resultant was 145° (SE) and 3.1 m. p. s. while the normal for this level was 243° (WSW). and 1.8 m. p. s. At Sault Ste. Marie the current month's resultant directions were 233° (SW.) and 182° (S.) at 2 and 2.5 km, respectively, while the corresponding normal directions were 297° (WNW.) and 303° (NW.). The current resultant velocities at Sault Ste. Marie were only 21 percent of normal at 2 km and 28 percent of normal at 2.5 km. At 4 km, furthermore, the current resultant velocity was only 1.7 m. p. s. as compared with a normal of 8.9 m. p. s. At Key West the current month's resultant directions varied from the normal in a counterclockwise direction at all levels up to 3 km where the direction was 81° (E.) and the normal 202° (SSW.).

Table 5 shows the maximum free-air wind velocities and their directions for various sections of the United States during May, as determined by pilot-balloon observations. The extreme maximum was 51.2 m. p. s. from the WSW. at 4,280 meters above sea level over Medford, Oreg.

The mean monthly equivalent potential temperatures and specific humidities are shown in tables 2 and 3, respectively. The increase in equivalent potential temperature of May over April amounted to about 10° A. on the average, the greatest change (+17° A.) occurred at Omaha at 0.5 km and the smallest (+2° A.) occurred at San Diego at 5 km. The average increase in specific humidity of May over April varied from 2 to 3 grams in the lower levels to 0.2 to 1.3 grams at 5 km. In general, the locations of centers of highest and lowest specific humidity and equivalent potential temperature agreed closely with those of highest and lowest pressure.

The weather of the month was characterized by frequent influxes of rather large areas of polar air which moved, for the most part, across the northern part of the country. During the early part of the month several cyclonic areas developed over the southern States and moved slowly north or northeast. In two cases these areas moved slightly northwestward and became temporarily stagnated over the central part of the country, when their eastward movement was blocked by large polar air masses.

During the latter half of the month several cyclones entered the country from the northwest or developed over the northern plains States and moved eastward across the country usually with troughs of low pressure extending to the southwest formed by inflowing tropical air from the region of the west Gulf States. In general both the horizontal and vertical temperature gradients along the fronts between the tropical and polar air currents, associated with the low pressure centers and troughs, were unusually steep and gave rise to an unusually large number of thunderstorms. The frequency of thunderstorms accounts for the very uneven amounts of percipitation which resulted, precipitation being below normal in 33 of the 48 States and above normal in the remainder. The deficiency of precipitation in California (24 percent of normal) appears to have resulted from an almost complete lack of frontal activity in that region and a lack of inflowing air from the Pacific. During the greater part of the month a more or less stationary low pressure center persisted over southern Nevada and Arizona. The circulation about this center resulted in dry N. or NE. winds blowing over the State from the mountains instead of NW. winds from the ocean which normally prevail during this month.

TABLE 1.—*Mean free-air temperatures (t), °C. obtained by airplanes during May 1937. (Dep. represents departure from "normal" temperature)*

Station	Altitude (meters) m. s. l.																			
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Number of obs.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	
Barksdale Field (Shreveport), La.[1] (52 m)	31	19.8	-----	20.0	-----	17.8	-----	15.1	-----	11.8	-----	8.9	-----	6.1	-----	0.5	-----	-----	-----	
Billings, Mont.[2] (1,089 m)	31	10.8	+0.8	-----	-----	-----	-----	12.8	+1.0	10.2	+1.0	6.7	+1.1	3.0	+1.1	−3.5	+1.5	−9.5	+2.3	
Boston, Mass.[1] (5 m)	24	11.8	−0.7	13.2	+1.6	11.1	+1.8	8.3	+1.8	5.3	+1.3	2.7	+1.0	−0.2	+0.7	−5.3	+0.7	-----	-----	
Cheyenne, Wyo.[2] (1,873 m)	31	7.0	+0.4	-----	-----	-----	-----	-----	-----	8.4	+1.0	7.0	+1.0	4.1	+1.1	−3.3	+0.8	−10.8	+0.7	
Coco Solo, C. Z.[3] (15 m)	23	25.8	-----	23.9	-----	21.3	-----	18.5	-----	15.8	-----	13.4	-----	10.9	-----	5.2	-----	−0.8	-----	
El Paso, Tex.[2] (1,194 m)	31	17.7	-----	-----	-----	-----	-----	20.3	-----	17.4	-----	13.9	-----	10.3	-----	2.2	-----	−5.7	-----	
Fargo, N. Dak.[2] (274 m)	30	9.8	+1.0	12.5	+0.6	10.6	+0.3	8.2	+0.5	5.8	+0.8	2.9	+0.8	0.0	+0.7	−5.8	+0.4	−12.4	+0.2	
Kelly Field (San Antonio), Tex.[1] (206 m)	31	19.4	+0.1	19.9	+0.2	18.4	−0.1	16.8	−0.1	14.3	−0.2	11.7	−0.2	8.8	−0.3	2.3	−0.2	−4.6	−0.2	
Lakehurst, N. J.[3] (39 m)	25	10.7	+0.1	14.4	+1.8	12.1	+1.5	8.7	+0.7	5.5	+0.1	2.8	−0.1	0.6	−0.2	−4.7	−0.6	−10.8	−1.0	
Maxwell Field (Montgomery), Ala.[1] (52 m)	26	20.7	+0.7	21.4	+0.2	18.3	0.0	14.6	−0.1	11.3	−0.5	8.1	−0.7	5.1	−0.8	0.0	−0.3	−5.7	−0.2	
Miami, Fla.[2] (4 m)	31	19.6	-----	21.2	-----	18.0	-----	15.0	-----	12.3	-----	10.2	-----	7.4	-----	1.9	-----	−3.5	-----	
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	27	11.8	+0.4	14.1	+0.7	12.4	+0.9	9.2	+0.4	6.1	0.0	3.2	−0.2	1.0	−0.2	−4.8	−0.5	-----	-----	
Murfreesboro, Tenn.[2] (174 m)	31	15.3	+0.1	17.4	−0.3	15.1	−0.8	12.5	−0.6	9.5	−0.8	6.7	−1.0	4.7	−0.5	−2.1	−0.9	−8.2	−0.9	
Norfolk, Va.[3] (10 m)	24	15.6	−1.9	16.6	−0.8	13.7	−1.6	10.2	−2.3	7.1	−2.4	5.2	−1.6	2.8	−1.4	−3.0	−1.6	−9.1	−1.6	
Oakland, Calif.[3] (2 m)	31	11.1	-----	13.6	-----	15.2	-----	13.8	-----	11.5	-----	8.8	-----	5.8	-----	−0.7	-----	−7.0	-----	
Oklahoma City, Okla.[2] (391 m)	31	17.1	+0.2	18.4	+0.9	19.1	+1.8	16.6	+1.5	13.9	+1.4	10.8	+1.3	7.4	+1.3	0.0	+1.1	−7.4	+1.0	
Omaha, Nebr.[2] (300 m)	31	14.0	+0.4	15.5	+0.8	14.8	+0.5	12.9	+0.8	9.8	+0.2	6.3	−0.3	3.3	−0.2	−3.1	+0.1	−9.8	+0.4	
Pearl Harbor, T. H.[3] (6 m)	31	21.3	−3.6	19.8	−1.4	16.8	−0.6	14.1	−0.5	11.9	−0.6	10.8	−0.6	8.7	−0.9	3.4	−1.2	−1.9	−0.1	
Pensacola, Fla.[3] (13 m)	29	20.4	−1.7	21.2	+0.4	17.9	−0.2	14.6	−0.6	11.4	−1.2	8.3	−1.7	5.5	−1.9	0.9	−0.7	−4.3	+0.2	
St. Thomas, Virgin Island[3] (8 m)	30	27.0	-----	23.4	-----	19.9	-----	17.3	-----	15.0	-----	12.4	-----	10.0	-----	4.6	-----	−0.6	-----	
Salt Lake City, Utah[2] (1,288 m)	31	11.5	-----	-----	-----	-----	-----	15.7	-----	13.1	-----	9.7	-----	6.0	-----	−1.0	-----	−7.8	-----	
San Diego, Calif.[3] (10 m)	22	16.0	−1.5	13.8	−0.4	14.4	+0.3	15.5	+2.2	13.6	+1.6	10.8	+1.5	8.0	+1.5	1.7	+1.2	−5.6	+0.6	
Sault Ste. Marie, Mich.[2] (221 m)	31	6.6	-----	9.9	-----	8.6	-----	6.2	-----	3.5	-----	0.9	-----	−1.6	-----	−7.2	-----	−13.5	-----	
Scott Field (Belleville), Ill.[1] (135 m)	28	13.8	+0.6	17.0	+0.2	14.9	0.0	12.6	+0.6	9.9	+0.6	6.9	+0.1	4.1	+0.1	−2.5	−0.3	−9.1	−0.5	
Seattle, Wash.[3] (10 m)	21	9.6	−2.6	8.5	−1.5	6.4	−1.2	3.6	−1.2	1.5	−0.5	−0.7	−0.3	−2.5	+0.2	−8.5	0.0	−15.3	−0.4	
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	31	10.0	+0.4	13.0	+0.6	10.8	+0.5	8.0	+0.6	5.3	+0.5	2.4	+0.2	−0.2	0.0	−6.1	−0.2	−11.9	+0.5	
Spokane, Wash.[3] (596 m)	31	9.2	−2.0	-----	-----	12.9	+0.2	10.7	−0.2	7.0	−0.7	3.3	−0.9	−0.1	−0.8	−6.2	−0.4	−12.9	+0.1	
Washington, D. C.[3] (13 m)	30	13.8	−2.1	15.5	+0.4	13.0	−0.2	9.9	−0.7	6.7	−1.4	4.1	−1.3	1.8	−1.1	−3.5	−1.1	−9.6	−1.2	
Wright Field (Dayton), Ohio[1] (244 m)	29	11.7	+0.4	14.1	0.0	13.4	+0.2	10.3	−0.1	8.0	+0.2	5.7	+0.4	3.2	+0.5	−2.3	+0.5	−8.6	+0.5	

[1] Army.
[2] Weather Bureau.
[3] Navy.

Observations taken about 4 a. m., 75th meridian time except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Billings, 93 (3); Boston, 127 (5); Cheyenne, 89 (3); Fargo, 92 (3); Kelly Field 85 (3); Lakehurst, 78 (3); Maxwell Field, 85 (3); Mitchel Field, 83 (3); Murfreesboro, 92 (3); Norfolk, 161 (8); Oklahoma City, 90 (3): Omaha, 186 (6); Pearl Harbor, 162 (7); Pensacola, 225 (10); San Diego, 196 (9); Scott Field, 80 (3); Seattle, 64 (3), Selfridge Field, 89 (3); Spokane, 93 (3); Washington, 224 (10); Wright Field, 88 (3).

TABLE 2.—*Mean free-air relative humidities (R. H.), in percent, and specific humidities (q), in grams/kilogram, obtained by airplanes during May 1937. (Dep. represents departure from "normal" relative humidity)*

Station	Altitude (meters) m. s. l.																						
	Surface				500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
	Number of observations	q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.	
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.
Barksdale Field, La.	30	11.3	79	----	10.0	65	----	8.6	60	----	7.0	55	----	5.8	53	----	4.9	51	----	4.0	47	----	3.2	49	----	----	----	----
Billings, Mont.	31	5.2	57	−7	----	----	----	----	----	----	5.2	48	−3	4.8	49	−2	4.2	52	−2	3.9	58	0	2.8	60	+1	1.7	49	−4
Boston, Mass.	24	6.5	76	+7	5.9	60	−1	5.2	57	−2	4.9	61	+1	4.1	59	0	3.6	59	+3	3.0	57	+3	2.2	51	+2	----	----	----
Cheyenne, Wyo.	31	5.7	74	−2	----	----	----	----	----	----	----	----	----	5.9	68	−3	5.3	63	0	4.3	60	+1	3.0	60	+1	1.9	62	+2
Coco Solo, Canal Zone	23	19.1	92	----	17.0	87	----	14.8	84	----	13.5	85	----	11.5	82	----	9.5	75	----	7.7	67	----	5.1	59	----	4.0	63	----
El Paso, Tex.	31	5.7	40	----	----	----	----	----	----	----	6.5	37	----	5.4	35	----	4.6	35	----	3.6	33	----	2.8	39	----	2.1	46	----
Fargo, N. Dak.	30	6.0	78	0	6.2	66	+2	5.9	67	+6	5.3	65	+6	4.3	61	+3	3.6	58	+2	3.2	56	+3	2.1	51	+2	1.3	50	+4
Kelly Field, Tex.	31	12.2	85	−6	12.5	82	−2	10.0	68	−6	8.0	57	−5	6.8	54	−3	5.4	48	−6	4.4	45	−4	3.2	45	−2	2.1	44	0
Lakehurst, N. J.	25	7.4	92	+6	6.7	63	0	5.7	59	0	5.1	61	0	4.3	59	0	3.6	58	0	2.8	48	−2	1.8	42	−3	1.0	33	−5
Maxwell Field, Ala.	26	12.0	78	−3	9.6	57	−5	8.2	55	−7	7.6	60	−4	6.3	58	+1	5.3	58	+3	4.2	53	+2	2.7	42	0	1.5	32	−1
Miami, Fla.	31	13.0	91	----	13.4	81	----	10.7	75	----	8.6	68	----	6.8	61	----	5.3	51	----	4.6	50	----	3.0	43	----	2.1	38	----
Mitchel Field, N. Y.	27	7.2	84	+2	7.4	71	+2	6.9	69	+2	6.2	72	+4	5.4	74	+4	4.5	69	+5	3.5	61	+2	2.3	55	+1	----	----	----
Murfreesboro, Tenn.	31	9.8	89	+3	8.2	63	−4	7.5	63	−2	6.8	64	−3	6.2	67	+2	5.1	62	+3	4.9	64	+7	2.6	51	+2	1.6	41	−2
Norfolk, Va.	24	9.0	82	+8	7.4	59	−3	6.4	58	0	5.3	59	+1	4.7	58	+1	3.6	50	−5	3.0	45	−7	1.8	38	−6	1.1	35	−6
Oakland, Calif.	30	6.9	85	----	7.2	70	----	5.9	49	----	4.3	37	----	3.5	33	----	2.9	31	----	2.4	30	----	1.6	28	----	1.1	27	----
Oklahoma City, Okla.	31	10.0	79	−4	10.0	72	−4	9.5	62	−1	8.5	61	+1	7.2	58	+2	6.0	56	+3	4.8	52	+3	3.1	51	+2	2.3	57	+8
Omaha, Nebr.	31	8.4	82	+3	8.3	72	0	7.2	62	−2	6.5	59	−2	5.5	58	0	4.8	61	+3	4.1	60	+5	2.8	58	+6	1.8	54	+4
Pearl Harbor, T. H.	31	12.7	81	+12	12.3	81	+6	11.4	85	+4	9.6	81	+4	7.5	69	+3	5.4	51	+2	4.1	42	+5	2.6	34	+7	1.9	32	+7
Pensacola, Fla.	29	13.5	91	+8	11.1	67	−8	9.1	64	−6	8.0	66	0	6.6	63	+4	5.3	58	+5	4.1	53	+5	2.5	38	−1	1.3	28	−5
St. Thomas, Virgin Island	30	17.5	79	----	16.2	86	----	14.2	88	----	11.9	81	----	9.1	71	----	7.4	62	----	5.7	53	----	4.6	56	----	3.2	49	----
Salt Lake City, Utah	31	5.7	58	----	----	----	----	----	----	----	6.5	49	----	5.6	47	----	4.8	48	----	4.2	51	----	3.2	56	----	2.4	61	----
San Diego, Calif.	22	8.9	78	+6	8.0	77	0	7.6	66	+3	6.3	48	−1	4.9	40	+2	3.8	36	+3	3.0	32	+3	1.9	28	+2	1.2	27	+3
Sault Ste. Marie, Mich.	31	4.8	78	----	5.4	67	----	5.0	64	----	4.4	62	----	3.9	63	----	3.4	61	----	2.8	58	----	1.8	50	----	1.0	42	----
Scott Field, Ill.	28	8.7	88	+2	7.9	62	+1	7.3	62	+3	6.4	60	+1	5.6	60	+1	4.7	56	+4	3.7	51	+2	2.6	52	+5	1.7	49	+6
Seattle, Wash.	21	6.2	85	+9	5.8	79	+4	4.9	74	+3	4.2	72	+3	3.7	67	0	3.0	62	0	2.6	58	0	1.7	53	+1	1.0	49	+1
Selfridge Field, Mich.	31	6.4	83	+1	6.5	66	+4	5.8	64	+4	4.8	60	+1	3.9	56	−1	3.2	53	0	2.6	48	0	1.7	44	+2	1.2	46	+6
Spokane, Wash.	31	5.2	68	+5	----	----	----	5.3	52	−2	4.6	48	−4	4.0	50	−2	3.5	54	−1	2.8	55	−3	2.0	51	−4	1.2	48	−1
Washington, D. C.	30	8.1	83	+12	6.5	57	−3	6.0	58	+2	5.3	60	+4	4.8	63	+7	4.0	59	+6	3.1	51	0	1.9	41	0	1.1	35	−1
Wright Field, Ohio	29	7.5	86	+1	7.4	70	+3	7.0	65	+4	6.0	66	+3	5.0	60	0	3.9	51	−3	3.3	48	−5	2.2	43	−7	1.4	42	−5

TABLE 3.—*Mean free-air barometric pressures (P), in mb, and equivalent potential temperatures (θ_a), in °A. obtained by airplanes during May 1937*

Station	Altitude (meters) m. s. l.																		
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
	Number of observations	P	θ_a	P	θ_a	P	θ_a	P	θ_a	P	θ_a	P	θ_a	P	θ_a	P	θ_a	P	θ_a
Barksdale Field, La	*31	1,009	323	957	325	903	324	851	323	802	321	754	320	710	321	628	323	-----	-----
Billings, Mont	31	891	308	-----	-----	-----	-----	849	315	800	317	752	316	708	317	624	318	550	318
Boston, Mass	24	1,015	302	957	306	902	307	849	309	799	309	751	310	706	311	622	314	-----	-----
Cheyenne, Wyo	31	812	314	-----	-----	-----	-----	-----	-----	800	318	752	320	708	320	624	319	550	318
Coco Solo, Canal Zone	23	1,009	352	952	350	900	346	849	345	800	342	754	340	710	337	629	335	557	335
El Paso, Tex	31	879	319	-----	-----	-----	-----	848	327	800	327	754	326	710	324	629	324	555	324
Fargo, N. Dak	30	981	301	955	307	900	309	847	310	797	310	750	310	704	312	620	314	546	315
Kelly Field, Tex	31	992	328	960	332	906	328	855	327	806	326	759	325	715	324	634	324	560	324
Lakehurst, N. J	25	1,011	303	958	310	903	310	850	310	800	310	753	310	708	311	624	313	550	315
Maxwell Field, Ala	26	1,010	326	959	326	906	324	854	323	805	321	757	320	713	319	630	320	556	321
Miami, Fla	31	1,014	327	958	336	905	330	853	327	805	324	757	323	714	323	631	324	557	326
Mitchel Field, N. Y	27	1,012	303	958	312	902	314	850	314	799	314	752	314	706	314	622	315	-----	-----
Murfreesboro, Tenn	31	995	316	960	317	904	319	852	319	802	320	755	319	710	321	628	318	554	319
Norfolk, Va	24	1,015	312	958	314	903	314	851	312	801	312	753	312	708	314	625	315	551	317
Oakland, Calif	*31	1,015	302	956	310	902	314	850	313	801	314	754	315	710	316	627	317	553	318
Oklahoma City, Okla	31	968	321	955	324	902	329	850	328	802	327	755	326	711	324	629	322	555	322
Omaha, Nebr	31	978	312	956	316	902	317	850	319	801	318	754	318	709	318	626	318	551	318
Pearl Harbor, T. H	31	1,016	328	960	331	906	331	854	329	805	325	758	324	714	323	632	324	558	327
Pensacola, Fla	29	1,016	330	961	329	907	326	854	325	805	323	757	321	712	320	630	321	556	323
St. Thomas, Virgin Islands	30	1,016	348	961	346	907	342	855	339	807	334	759	331	715	329	634	331	560	332
Salt Lake City, Utah	31	869	313	-----	-----	-----	-----	847	322	798	322	751	322	708	322	625	322	552	323
San Diego, Calif	22	1,013	312	956	313	900	318	848	322	800	320	753	320	709	320	627	321	553	321
Sault Ste. Marie, Mich	31	989	294	957	301	901	304	847	306	797	307	749	308	704	309	620	311	546	312
Scott Field, Ill	28	1,000	311	959	316	905	318	853	318	804	318	756	318	711	317	628	318	554	318
Seattle, Wash	21	1,018	298	960	301	902	302	848	302	798	304	749	305	704	307	620	309	545	310
Selfridge, Mich	31	994	301	957	308	902	309	850	308	800	308	752	309	706	310	622	311	548	315
Spokane, Wash	31	945	302	-----	-----	901	310	849	311	799	311	751	311	706	310	622	312	549	313
Washington, D. C	30	1,017	308	959	311	903	312	851	312	801	313	753	313	708	313	624	315	550	317
Wright Field, Ohio	29	987	307	956	312	901	315	849	315	800	315	752	314	708	315	625	317	551	319

* θ_a 30 observations.

TABLE 4.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during May 1937*

[Wind from N.=360°, E.=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	85	1.3	4	0.2	333	2.3	285	1.3	270	2.5	234	0.1	87	0.4	249	0.9	111	1.8	89	0.8	68	1.8	276	0.6	188	0.4
500	-----	-----	270	0.02	-----	-----	311	6.0	-----	-----	207	1.2	173	2.5	246	2.6	148	3.0	178	5.1	87	3.6	283	1.2	190	1.5
1,000	-----	-----	260	2.0	-----	-----	312	5.1	-----	-----	284	2.7	244	3.4	263	4.0	236	2.6	183	4.6	73	3.1	315	1.8	249	3.6
1,500	-----	-----	259	3.7	334	1.7	311	4.3	-----	-----	276	3.6	271	6.2	282	4.3	255	1.9	181	3.8	83	1.6	160	0.5	264	5.6
2,000	160	1.0	277	5.2	302	1.6	296	5.0	278	3.2	289	3.2	296	5.3	280	6.2	269	3.8	185	2.6	63	1.3	179	1.8	273	6.3
2,500	255	3.2	279	4.8	283	2.7	294	5.7	292	4.8	293	5.8	323	2.8	281	6.6	311	5.3	223	2.4	77	1.5	221	3.2	282	7.2
3,000	281	3.8	294	4.7	266	3.8	269	7.4	292	5.6	298	8.0	-----	-----	277	6.3	312	5.7	273	2.0	81	1.2	242	5.2	293	6.5
4,000	267	6.5	-----	-----	253	4.9	281	6.8	284	6.9	299	7.7	-----	-----	299	8.6	315	9.9	332	3.1	-----	-----	285	5.4	-----	-----
5,000	242	7.5	-----	-----	192	3.6	-----	-----	280	6.9	-----	-----	-----	-----	321	8.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Altitude (meters) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	249	1.6	216	1.0	184	2.9	154	0.7	47	3.4	334	1.7	190	0.5	139	2.6	326	0.3	3	0.5	153	1.2	147	1.0	284	0.5
500	281	6.7	302	3.3	173	3.8	202	1.7	72	6.3	300	2.0	201	2.6	-----	-----	331	0.7	10	1.2	161	1.0	-----	-----	269	5.2
1,000	285	6.4	343	5.4	209	7.6	240	4.4	85	5.5	229	1.4	253	3.6	-----	-----	356	2.5	313	2.0	159	1.9	186	1.3	283	5.4
1,500	287	7.2	339	2.7	231	6.0	246	5.5	101	4.0	221	1.8	279	4.3	138	2.2	12	4.8	349	2.4	143	2.5	227	2.0	271	4.7
2,000	293	6.7	310	1.7	243	5.6	260	5.0	99	3.1	206	1.7	275	5.0	207	1.0	33	4.2	233	1.2	145	3.1	229	2.6	269	6.6
2,500	303	6.0	309	3.1	264	5.3	285	4.8	98	1.8	230	1.7	281	5.1	246	2.4	-----	-----	182	1.8	166	4.6	248	3.5	278	7.7
3,000	303	7.3	251	3.3	272	5.2	298	6.0	64	2.4	305	1.8	296	7.4	270	3.2	-----	-----	337	2.5	207	3.8	250	5.3	269	8.1
4,000	316	9.5	267	4.6	324	5.0	275	5.5	29	2.9	7	1.6	298	7.6	258	5.9	-----	-----	353	1.7	-----	-----	241	6.6	278	6.7
5,000	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	269	8.3	-----	-----	-----	-----	-----	-----	-----	-----	284	8.6

[1] Navy stations.

TABLE 5.—*Maximum free-air wind velocities (M. P. S.), for different sections of the United States based on pilot-balloon observations during May 1937*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.		Station
Northeast [1]	31.5	SW	1,046	13	Cleveland	37.0	WNW	4,410	17	Columbus	44.8	WNW	6,095	18	Cleveland.
East-Central [2]	26.2	W	1,860	16	Cincinnati	31.6	W	3,160	17	Washington	44.0	W	11,520	1	Greensboro.
Southeast [3]	25.5	E	660	1	Tampa	24.5	WSW	2,680	5	Spartanburg	34.1	W	11,280	4	Charleston.
North-Central [4]	30.2	NW	1,382	12	Bismark	30.8	NW	3,890	19	Detroit	40.0	NW	10,570	14	St. Paul.
Central [5]	30.2	SSW	2,460	11	Davenport	29.0	NW	4,240	17	Chicago	33.5	NNW	7,360	14	Wichita.
South-Central [6]	28.8	S	1,010	19	Oklahoma City	33.6	SW	3,550	20	Amarillo	41.2	SW	12,690	31	Abilene.
Northwest [7]	25.8	SE	2,440	2	Seattle	51.2	WSW	4,280	28	Medford	39.9	WSW	9,294	14	Portland.
West-Central [8]	35.7	SSW	2,470	18	Modena	39.6	SW	3,735	14	Modena	39.6	W	7,610	15	Rock Springs.
Southwest [9]	33.4	WSW	1,902	15	Winslow	40.0	SSW	4,638	25	Winslow	36.5	S	6,684	28	Albuquerque.

1 Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
2 Delaware, Maryland, Virginia, West Virginia, Southern Ohio, Kentucky, Eastern Tennessee, and North Carolina.
3 South Carolina, Georgia, Florida, and Alabama.
4 Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
5 Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
6 Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
7 Montana, Idaho, Washington, and Oregon.
8 Wyoming, Colorado, Utah, northern Nevada, and northern California.
9 Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

RIVERS AND FLOODS

[River and Flood Division, MERRILL BERNARD in charge]

By BENNETT SWENSON

The following report of flood losses for the Ohio River and tributaries at and above Wheeling, W. Va., during the flood of April 26, was received too late for inclusion in the April REVIEW and is presented herewith: Allegheny River, $352,000; Monongahela River, $788,000; and the Ohio River at and above Wheeling, W. Va., $533,300. Reported savings as a result of flood warnings for this section amounted to about $1,500,000.

Atlantic Slope and East Gulf Drainage.—Most of the streams in this area from North Carolina southward reached flood stage late in April or the first part of May as a result of rains during the latter part of April. Additional rains occurred during the first week of May, particularly over portions of the East Gulf States, and increased the stages considerably in the Tombigbee River. No losses of consequence occurred as a result of these floods, except as follows: Altamaha River, $33,750; Apalachicola River, $5,500; and Tombigbee River, $171,000.

Frequent rains in the New England States during most of the month, with unusually heavy rains occurring on the 14th and 15th, resulted in a moderate flood in the Connecticut River. Reports of losses have not been received.

Upper Mississippi Valley.—The flood in the Illinois River began about April 21 and continued through the third week in May. The flood was light, and the only loss of consequence was to prospective crops, with a total loss amounting to $25,000.

A small flood occurred in the Meramec River during the first week of May, but no losses of consequence were reported.

Missouri Valley.—Heavy rains over the upper and middle Floyd and Big Sioux River watersheds on the night of May 25–26 resulted in flooding in these basins. The losses in the Floyd River amounted to about $44,000 and in the Big Sioux River, $15,000.

The following item of interest, concerning the low stage in the Missouri River at Sioux City, Iowa, during May has been furnished by the official in charge at that station:

From May 14 to 26, inclusive, the Missouri River was at the lowest stage of record for the month of May at the Sioux City station. 4.6 feet on May 26, 1931, was the previous low stage. On May 24, 1937, the gage reading was 3.6 feet, or 1.0 foot under the previous low reading for May. The record begins with 1879, and it is continuous for a period of 59 years.

The average stage for May 1937 at Sioux City was 4.6 feet, or 3.7 feet below the 59-year average. This was one-half foot lower than the average stage in 1889 and 1931, the previous low.

The accompanying graph, also prepared at Sioux City, Iowa, shows the marked decline of the summer stages in the Missouri River at Sioux City during the last 17 years. These changing conditions are well illustrated by the low level of the water table in recent years in the middle Missouri Valley.

Ohio and lower Mississippi Valleys.—Heavy rains during the first four days of May caused moderate floods in the lower White and the middle and lower Wabash Rivers. The damage was mostly to prospective crops and amounted to about $14,000.

Light floods occurred in the lower Cumberland and in the Green River in Kentucky, but no losses of consequence were incurred.

The crest of the April flood in the upper Ohio River flattened out as it progressed downstream and did not exceed flood stage after passing Point Pleasant, W. Va. However, a weak low-pressure area appeared over the lower Mississippi Valley on the first of May and moved slowly northward to southeastern Missouri, where it remained almost stationary until the 5th before it finally moved eastward. This condition caused frequent and widespread rains over the central Mississippi and lower Ohio River Basins. These rains augmented the rise in the Ohio River so that shortly before the rise reached Evansville, Ind., flood stage was again exceeded and the flooding continued downstream to the mouth of the Ohio and on the lower Mississippi to Helena, Ark. Moderate flooding also occurred in the White and St. Francis Rivers in Missouri and Arkansas. The principal damage was to prospective crops. The total losses reported were as follows: Ohio River, $70,000; Mississippi River, $172,000; and White River, $82,400.

A local flood occurred on the Ninnescah River, a tributary of the Arkansas River, near Cheney, Kans., as the result of excessive rains on the 26th. A total loss of about $30,000 was reported. The North Canadian and South Canadian Rivers, also tributaries of the Arkansas, were